Description of a Rare New Cliff-dwelling Species from Kaua'i, *Schiedea attenuata* (Caryophyllaceae)

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ABSTRACT. A new species of *Schiedea* is described and illustrated. It is restricted to the sheer Kalalau cliffs on the island of Kaua'i, the oldest main island of the Hawaiian Islands. It is most closely related to the sea-cliff species *S. globosa* H. Mann from O'ahu, Moloka'i, and Maui.

Recent collecting activities in the Hawaiian Islands by Kenneth R. Wood for his own investigations of Kaua'i and for the Hawaii Plant Conservation Center of the National Tropical Botanical Garden, especially rappelling the vast cliffs of Kalalau Valley, Kaua'i, have yielded more than a dozen new species since the publication of the *Manual of the Flowering Plants of Hawai'i* (Wagner et al., 1990). Wood collected a highly distinctive new species of *Schiedea* Chamisso & Schlechtendal on one of these rappels. This species, described herein as *Schiedea attenuata* W. L. Wagner et al., is characterized by glossy, succulent, long-attenuate leaves, a short, relatively open inflorescence, perfect flowers with recurved nectary shafts, and 5–6(7) carpels. It has been collected twice on rappels into Kalalau Valley on the Kalahu side below and west of the first lookout (southwesternmost) at 700–800 m. Although the diverse mesic cliff plant communities on the upper Kalalau Valley north-facing cliffs are outstanding assemblages of rare species, fewer than 20 individuals of this new species were noted by Wood during his extensive investigations. The southwestern corner of the upper Kalalau Valley has habitats that may harbor additional populations of this rare species.

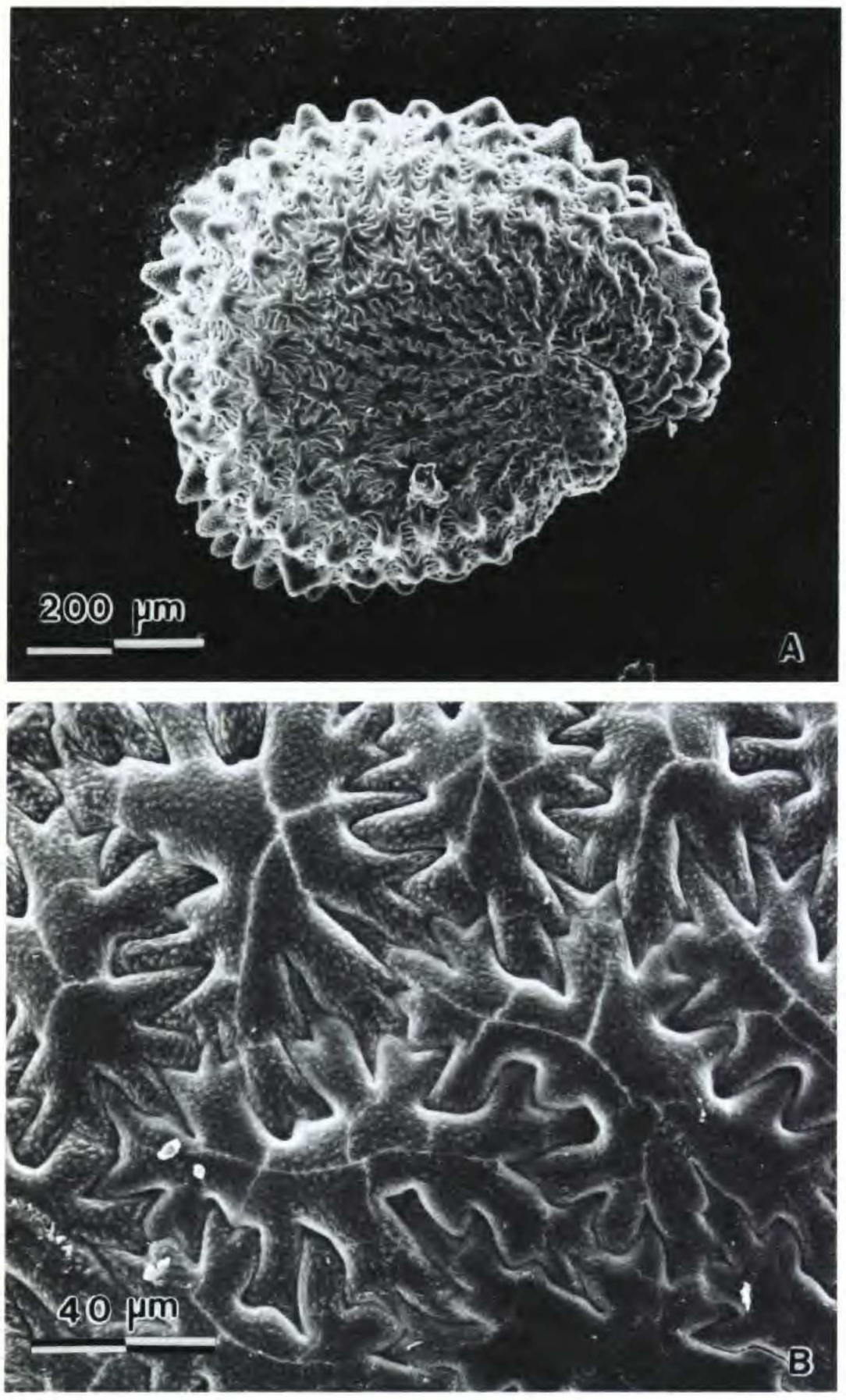
Plants grown from seed are currently under cultivation in the University of California at Irvine greenhouse as part of a collaborative study on the phylogeny and evolution of dioecy in this endemic Hawaiian genus. The extensive Kalalau Valley harbors about 20% of the species of the lineage to which *Schiedea* belongs, including, in addition to *S. attenuata*, *Alsinidendron lychnoides* (Hillebrand) Sherff, *Schiedea apokremnos* H. St. John, *S. membranacea* H. St. John, *S. nuttallii* W. J. Hooker, and *S. spergulina* A. Gray var. *spergulina*.

Schiedea and *Alsinidendron* constitute a monophyletic radiation in the Hawaiian Archipelago, based on the presence of highly specialized floral nectaries and the absence of petals in all species. Nectar is collected and presented through a hypodermic-like shaft in *Schiedea* and at the base of a flap- or cup-like structure in *Alsinidendron*. In a majority of the members of the subfamily Alsinoideae, to which the endemic Hawaiian genera belong (Pax & Hoffmann, 1934; Weller et al., 1990), the nectary is represented by a mound of nectariferous tissue bisected by a lateral furrow located on the abaxial side of each antesepalous stamen (Thomson, 1942). Ontogenetic studies indicate that the nectary differences between *Schiedea* and *Alsinidendron* represent changes in homologous structures (E. Harris and Wagner, unpublished obs.).

A preliminary phylogenetic analysis by us suggests that *Schiedea attenuata* is the sister species of the most widespread species, *S. globosa* H. Mann, a sea-cliff species found on O'ahu, Moloka'i, and Maui. Both of these species share the derived characters of succulent leaves, recurved nectary shafts, and more styles than the typical three found in most *Schiedea* species. *Schiedea globosa* differs in possessing a specialized dense globose inflorescence, a subdioecious breeding system, and a more sprawling habit. The phylogenetic analysis suggests that the hermaphroditic condition of *S. attenuata* may be secondarily derived.

Schiedea attenuata W. L. Wagner, Weller & Sakai, sp. nov. TYPE: Hawaiian Islands. Kaua'i: Hanalei District, Kalalau rim, Kalahu side below and W of first Kalalau lookout, 300 m E of plane crash [site], [22°8′N, 159°39′W, NW

Figure 1. *Schiedea attenuata* W. L. Wagner et al. —A. Habit, showing upright woody habit, slightly falcate leaves, and inflorescence. —B. Leaf, showing venation, drawn from leaf with epidermis peeled away. —C. Telescoped view showing minute hairs on leaf abaxial surface near the base. —D. Flower at early anthesis, just prior to anther



Schiedea attenuata

Figure 2. Scanning electron (SEM) photomicrographs of *Schiedea attenuata* seed from holotype. —A. Lateral view at ×100. —B. Epidermal cells of testa on face at ×500.

aspect], 790 m, 20 Nov. 1991, *K. R. Wood 1394* (holotype, US-3238878; isotype, PTBG). Figures 1, 2.

Haec species *Schiedea globosa* H. Mann habitu erectiore, inflorescentiis cymosis laxioribus 4–9 cm longis, floribus hermaphroditis inter se 2.5–13 cm distantibus et stylis 5(–6) differt.

Erect, sparingly branched shrub to 75 cm tall; internodes usually 2–9 mm long, sparsely puberulent with minute ± purplish weakly hooked or curved hairs. Leaves opposite, thick, firm and somewhat succulent, glossy, 5.3–7 cm long (to 12 cm in cultivation), 5–7 mm wide (to 11 mm in cultivation), linear-lanceolate or linear-elliptic, slightly falcate in upper half, 1- or 3-nerved; only the midrib prominent, strongly raised on abaxial surface and impressed on adaxial surface; margin slightly revolute; margin and abaxial surface sparsely puberulent near base; apex long-attenuate; base narrowly acute, gradually tapering and weakly connate. Inflorescences terminal open cymes 4–9 cm long with 14–55 flowers; lowest bracts 11 mm long, 7–8 mm wide; internodes 3–28 mm long; pedicels 8–15(–19) mm long. Flowers perfect; sepals 4–5 mm long, lanceolate, green with conspicuous scarious margins, strongly concave in upper half, reminiscent of a canoe prow, apex weakly acuminate; petals absent; nectary shafts ca. 3 mm long, recurved and appressed to the opposed sepal, the apex with an abaxial slit ca. 0.06–0.08 mm long, apparently directly releasing nectary onto the sepal; stamens 10; filaments 4.5–5.5 mm long; styles 5–6(7). Capsules ca. 4.5 mm long, dehiscent by 5–6(7) valves; seeds ca. 0.6 mm long, dark reddish brown, orbicular-reniform, compressed, the faces transversely rugose, the margins papillose; margins of testa cells obtuse to rounded.

Distribution. Known only from the cliffs of Kalalau Valley at 700–800 m, Kaua'i, Hawaiian Islands. The habitat of this site was characterized by the collector as "diverse mesic forest pockets and vertical cliffs [open canopy]; weathered basalt with occasional pockets of brown soil, growing with *Gouania* [*meyenii*], *Peucedanum* [*sandwicense*], *Poa mannii*, *Hedyotis* sp., *Lysimachia glutinosa*, *Melicope pallida*, *Nototrichium* sp. nov., *Dubautia* sp., *Dryopteris unidentata*, *Metrosideros* [*polymorpha*], *Coprosma* sp., *Vaccinium* sp., *Lipochaeta* sp., *Wilkesia* sp., *Lobelia niihauensis*, *Lepidium* [*serra*], *Nestegis* [*sandwicensis*], *Hibiscus kokio*, *Eragrostis* sp.; major threats—goats, *Erigeron* [*karvinskianus*], *Rubus* [*argutus*], *Verbena* [*littoralis*], *Lantana* [*camara*], *Setaria* sp., *Kalanchoë pinnata*, *Lythrum* [*maritimum*], and land slides."

Paratypes. HAWAIIAN ISLANDS. **Kaua'i:** Hanalei District, Kalalau rim, Kalahu side below and W of first Kalalau lookout, 300 m E of plane crash [site], [22°8′N, 159°39′W], 700–800 m, diverse mesic forest pocket and vertical cliffs, 22 Nov. 1991, *K. R. Wood 1423* (PTBG).

Acknowledgments. We thank Ken Wood for calling our attention to this interesting new species

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dehiscence. —E. Flower in late anthesis, showing styles at final receptive stage. —F. Telescoped view of flower showing nectary shaft; shaft raised to show apical opening. —G. Early fruiting stage. —H. Seed, showing the rugose face and papillose margin. A, C–G drawn from *Wood 1394* (live collection, no voucher) cultivated at the University of California, Irvine, and from seeds from the isotype (PTBG). B and H drawn from holotype, *Wood 1394*.

and for providing us with pressed material, seeds, and cuttings of it as well as additional information about the type locality; Alice Tangerini for her accurate and excellent composite illustration; Robynn Shannon for assistance with the manuscript; E. Harris for SEMs; and Dan Nicolson for providing the Latin diagnosis.

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